

WHAT IS CLAIMED IS

*sub. 0.8* 1. A liquid crystal display device having a transparent first substrate, a transparent second substrate, and a liquid crystal layer and a color filter layer sandwiched between the first and second  
5 substrates, comprising:

said color filter layer disposed on said first substrate;  
said liquid crystal layer disposed between said color filter layer and said second substrate;

plural scan signal electrodes, video signal electrodes for  
10 crossing said scan signal electrodes in a matrix form and plural thin film transistors formed in association with the crossing points between said scan signal electrodes and said video signal electrodes provided on said first substrate below said color filter layer;

15 at least one pixel formed in each of areas surrounded by said plural scan signal electrodes and said video signal electrodes;

each pixel provided with a common electrode which is connected over plural pixels through a common electrode wire to supply reference potential, and a pixel electrode which is connected to  
20 the corresponding thin film transistor and disposed so as to confront said common electrode in said pixel area; and

said common electrode and said pixel electrode disposed between said color filter layer and said liquid crystal layer;

wherein said common electrode and said pixel electrode are  
25 disposed in different layers through an interlayer separation film formed of a transparent insulating material, and

wherein electric field having a component which is dominantly parallel to said first substrate is produced in said liquid crystal

layer by applying a voltage across said common electrode and said pixel electrode, and liquid crystal before the voltage is applied thereto is orientated substantially in parallel to said first substrate.

5        2.     The liquid crystal display device as claimed in claim 1, wherein at least one of said common electrode and said pixel electrode is formed of a transparent conductive film.

10       3.     The liquid crystal display device as claimed in claim 1, wherein said common electrode is formed on said color filter layer, said interlayer separation film is formed on said common electrode, and said pixel electrode is formed on said interlayer separation film.

15       4.     The liquid crystal display device as claimed in claim 1, wherein an overcoat layer for protecting said color filter layer is formed on said color filter layer, said common electrode is formed on said overcoat layer, said interlayer separation film is formed on said common electrode, and said pixel electrode is formed on said interlayer separation film.

20       5.     The liquid crystal display device as claimed in claim 1, wherein an overcoat layer for protecting said color filter layer is formed on said color filter layer, said pixel electrode is formed on said overcoat layer, said interlayer separation film is formed on said pixel electrode, and said common electrode is formed on said interlayer separation film.

25       6.     The liquid crystal display device as claimed in claim 1, wherein said common electrode is formed in a grid shape so as to surround a pixel; said pixel electrode is disposed so as to traverse the pixel; and said common electrode commonly uses a part

of said common electrode wire.

7. The liquid crystal display device as claimed in claim 1, wherein a plurality of said common electrodes and said pixel electrodes are arranged in the pixel.

5 8. The liquid crystal display device as claimed in claim 6, wherein said common electrode is formed so that the thin film transistor is hidden when viewed from the side of said second substrate.

10 9. The liquid crystal display device as claimed in claim 6, wherein said common electrode is formed so that said scan signal electrodes and said video signal electrodes are hidden when viewed from the side of said second substrate.

15 10. A liquid crystal display device having a first substrate, a second substrate, and a liquid crystal layer and a color filter layer sandwiched between the first and second substrates, comprising:

said color filter layer disposed on said first substrate;

said liquid crystal layer disposed between said color filter layer and said second substrate;

20 plural scan signal electrodes, video signal electrodes for crossing said scan signal electrodes in a matrix form and plural thin film transistors formed in association with the crossing points between said scan signal electrodes and said video signal electrodes provided on said first substrate below said color filter layer;

25 at least one pixel formed in each of areas surrounded by said plural scan signal electrodes and said video signal electrodes;

each pixel provided with a common electrode which is connected over plural pixels through a common electrode wire to supply

reference potential;

a pixel electrode which is connected to the corresponding thin film transistor disposed so as to confront said common electrode in said pixel area;

5        said common electrode and said pixel electrode disposed between said color filter layer and said liquid crystal layer;

      said common electrode and said pixel electrode disposed in different layers through an interlayer separation film formed of a transparent insulating material;

10       wherein electric field having a component which is dominantly parallel to said first substrate is produced in said liquid crystal layer by applying a voltage across said common electrode and said pixel electrode, and

      wherein liquid crystal before the voltage is applied thereto is  
15       orientated substantially vertically to said first substrate.

11.       The liquid crystal display device as claimed in claim 10,

      wherein at least one of said common electrode and said pixel electrode is formed of a transparent conductive film.

12.       The liquid crystal display device as claimed in claim 10,

20       wherein said common electrode is formed on said color filter layer, said interlayer separation film is formed on said common electrode, and said pixel electrode is formed on said interlayer separation film.

13.       The liquid crystal display device as claimed in claim 10,

25       wherein an overcoat layer for protecting said color filter layer is formed on said color filter layer, said common electrode is formed on said overcoat layer, said interlayer separation film is formed on said common electrode, and said pixel electrode is formed on said

interlayer separation film.

14. The liquid crystal display device as claimed in claim 10,  
wherein an overcoat layer for protecting said color filter layer  
is formed on said color filter layer, said pixel electrode is formed  
5 on said overcoat layer, said interlayer separation film is formed  
on said pixel electrode, and said common electrode is formed on said  
interlayer separation film.

15. The liquid crystal display device as claimed in claim 10,  
wherein said common electrode is formed in a grid shape so as  
10 to surround a pixel; said pixel electrode is disposed so as to  
traverse the pixel; and said common electrode commonly uses a part  
of said common electrode wire.

16. The liquid crystal display device as claimed in claim 10,  
wherein a plurality of said common electrodes and said pixel  
15 electrodes are arranged in the pixel.

17. The liquid crystal display device as claimed in claim 15,  
wherein said common electrode is formed so that the thin film  
transistor is hidden when viewed from the side of said second  
substrate.

18. The liquid crystal display device as claimed in claim 15,  
wherein said common electrode is formed so that said scan signal  
electrodes and said video signal electrodes are hidden when viewed  
from the side of said second substrate.

19. The liquid crystal display device as claimed in claim 10,  
25 wherein an optically negative compensation film and an  
optically positive compensation film are disposed between said first  
or second substrate and a polarizing plate to make anisotropy of  
refractive index of said liquid crystal layer and said compensation

film isotropic.

20. The liquid crystal display device as claimed in claim 19,  
wherein a pre-tilt angles are beforehand formed along two  
directions in which liquid crystal molecules are felled when a  
5 voltage is applied.

21. The liquid crystal display device as claimed in claim 19,  
wherein a pre-tilt angle is beforehand formed in any one of  
directions in which liquid crystal molecules are felled when a  
voltage is applied.

10 22. The liquid crystal display device as claimed in claim 10,  
wherein liquid crystal contains an organic polymer compound.

23. A method of manufacturing a liquid crystal display device  
comprising a first substrate, a second transparent second substrate,  
and a liquid crystal layer and a color filter layer sandwiched between  
15 said first and second substrates, comprising the steps of:

forming said color filter layer on said first substrate;

forming said liquid crystal layer between said color filter  
and said second substrate;

forming, on said first substrate below said color filter layer,  
20 plural scan signal electrodes, plural video signal electrodes  
crossing said scan signal electrodes in a matrix form, and plural  
thin film transistors in association with the crossing points between  
said scan signal electrodes and said video signal electrodes;

forming at least one pixel in each of areas surrounded by said  
25 plural scan signal electrodes and said plural video signal  
electrodes;

forming, in each pixel, a common electrode which is connected  
over plural pixels through a common electrode wire to supply

reference potential, and a pixel electrode which is connected to the corresponding thin film transistor and disposed so as to confront said common electrode in said pixel area;

disposing said common electrode and said pixel electrode  
5 between said color filter layer and said liquid crystal layer, and disposing said common electrode and said pixel electrode in different layers through an interlayer separation film formed of transparent insulating material;

forming liquid crystal so as to be oriented substantially  
10 vertically to said first substrate when no voltage is applied across said common electrode and said pixel electrode; and

adding an organic material comprising monomers or oligomers into said liquid crystal, injecting said liquid crystal into the gap between said first substrate and said second substrate, and then  
15 polymerizing said organic material in said liquid crystal.

24. A method of manufacturing a liquid crystal display device comprising a first substrate, a second transparent second substrate, and a liquid crystal layer and a color filter layer sandwiched between said first and second substrates, comprising the steps of:

20 forming said color filter layer on said first substrate;

forming said liquid crystal layer between said color filter and said second substrate;

forming, on said first substrate below said color filter layer, plural scan signal electrodes, plural video signal electrodes  
25 crossing said scan signal electrodes in a matrix form, and plural thin film transistors in association with the crossing points between said scan signal electrodes and said video signal electrodes;

forming at least one pixel in each of areas surrounded by said

plural scan signal electrodes and said plural video signal electrodes;

forming, in each pixel, a common electrode which is connected over plural pixels through a common electrode wire to supply  
5 reference potential, and a pixel electrode which is connected to the corresponding thin film transistor and disposed so as to confront said common electrode in said pixel area;

disposing said common electrode and said pixel electrode between said color filter layer and said liquid crystal layer, and  
10 disposing said common electrode and said pixel electrode in different layers through an interlayer separation film formed of transparent insulating material; and

forming an optically negative compensation film and an optically positive compensation film between said first or second  
15 substrate and a polarizing plate, and forming, by a rubbing method, pretilt angles along two directions in which liquid crystal molecules are felled when a voltage is applied to said compensation films.

25. A method of manufacturing a liquid crystal display device comprising a first substrate, a second transparent second substrate, and a liquid crystal layer and a color filter layer sandwiched between  
20 said first and second substrates, comprising the steps of:

forming said color filter layer on said first substrate;

forming said liquid crystal layer between said color filter and said second substrate;

25 forming, on said first substrate below said color filter layer, plural scan signal electrodes, plural video signal electrodes crossing said scan signal electrodes in a matrix form, and plural thin film transistors in association with the crossing points between



said scan signal electrodes and said video signal electrodes;

forming at least one pixel in each of areas surrounded by said plural scan signal electrodes and said plural video signal electrodes;

5 forming, in each pixel, a common electrode which is connected over plural pixels through a common electrode wire to supply reference potential, and a pixel electrode which is connected to the corresponding thin film transistor and disposed so as to confront said common electrode in said pixel area;

10 disposing said common electrode and said pixel electrode between said color filter layer and said liquid crystal layer, and disposing said common electrode and said pixel electrode in different layers through an interlayer separation film formed of transparent insulating material;

15 forming liquid crystal so as to be oriented substantially vertically to said first substrate when no voltage is applied across said common electrode and said pixel electrode; and

forming an optically negative compensation film and an optically positive compensation film between said first or second  
20 substrate and a polarizing plate, and forming, by a rubbing method, a pretilt angle in any one of directions in which liquid crystal molecules are felled when a voltage is applied to said compensation films.

26. A method of manufacturing a liquid crystal display device  
25 comprising a first substrate, a second transparent second substrate, and a liquid crystal layer and a color filter layer sandwiched between said first and second substrates, comprising the steps of:

forming said color filter layer on said first substrate;

forming said liquid crystal layer between said color filter and said second substrate;

forming, on said first substrate below said color filter layer, plural scan signal electrodes, plural video signal electrodes  
5 crossing said scan signal electrodes in a matrix form, and plural thin film transistors in association with the crossing points between said scan signal electrodes and said video signal electrodes;

forming at least one pixel in each of areas surrounded by said plural scan signal electrodes and said plural video signal  
10 electrodes;

forming, in each pixel, a common electrode which is connected over plural pixels through a common electrode wire to supply reference potential, and a pixel electrode which is connected to the corresponding thin film transistor and disposed so as to confront  
15 said common electrode in said pixel area;

disposing said common electrode and said pixel electrode between said color filter layer and said liquid crystal layer, and disposing said common electrode and said pixel electrode in different layers through an interlayer separation film formed of transparent  
20 insulating material;

forming liquid crystal so as to be oriented substantially vertically to said first substrate when no voltage is applied across said common electrode and said pixel electrode; and

forming an optically negative compensation film and an  
25 optically positive compensation film between said first or second substrate and a polarizing plate, and forming, by light irradiation, pretilt angles in two directions in which liquid crystal molecules are felled when a voltage is applied to said compensation films.

27. A method of manufacturing a liquid crystal display device comprising a first substrate, a second transparent second substrate, and a liquid crystal layer and a color filter layer sandwiched between said first and second substrates, comprising the steps of:

5       forming said color filter layer on said first substrate;  
      forming said liquid crystal layer between said color filter and said second substrate;

      forming, on said first substrate below said color filter layer, plural scan signal electrodes, plural video signal electrodes  
10   crossing said scan signal electrodes in a matrix form, and plural thin film transistors in association with the crossing points between said scan signal electrodes and said video signal electrodes;

      forming at least one pixel in each of areas surrounded by said plural scan signal electrodes and said plural video signal  
15   electrodes;

      forming, in each pixel, a common electrode which is connected over plural pixels through a common electrode wire to supply reference potential, and a pixel electrode which is connected to the corresponding thin film transistor and disposed so as to confront  
20   said common electrode in said pixel area;

      disposing said common electrode and said pixel electrode between said color filter layer and said liquid crystal layer, and disposing said common electrode and said pixel electrode in different layers through an interlayer separation film formed of transparent  
25   insulating material;

      forming liquid crystal so as to be oriented substantially vertically to said first substrate when no voltage is applied across said common electrode and said pixel electrode; and

forming an optically negative compensation film and an optically positive compensation film between said first or second substrate and a polarizing plate, and forming, by light irradiation, a pretilt angle in any one of directions in which liquid crystal molecules are felled when a voltage is applied to said compensation films.

28. The method as claimed in claim 26, wherein the light irradiation to forming the pretilt angles is conducted on the surfaces of said compensation films from a slant direction.

29. The method as claimed in claim 28, wherein the light irradiation for forming the pretilt angles is conducted by irradiating polarized light the surfaces of said compensation films from a slant direction.

30. The method as claimed in claim 27, wherein the light irradiation for forming the pretilt angle is conducted on the surfaces of said compensation films from a slant direction.

31. The method as claimed in claim 28, wherein the light irradiation for forming the pretilt angles is conducted by irradiating polarized light on the surfaces of said compensation films from a slant direction.

32. A method of manufacturing a liquid crystal display device comprising the steps of:

forming a thin film on a transparent substrate;

forming a passivation film for protecting said thin film transistor;

successively coating, light-exposing, developing and baking plural photosensitive color resists to form a color filter;

forming a common electrode; and

forming an interlayer separation film of a transparent insulating film.

33. A method of manufacturing a liquid crystal display device comprising the steps of:

- 5        forming a thin film on a transparent substrate;  
      forming a passivation film for protecting said thin film transistor;  
      successively coating, light-exposing, developing and baking plural photosensitive color resists to form a color filter;  
10       forming an overcoat film for protecting said color filter;  
      forming a common electrode; and  
      forming an interlayer separation film of a transparent insulating film.

34. The liquid crystal display device as claimed in claim 33,

- 15       wherein said common electrode is formed in a grid shape so as to surround a pixel; said pixel electrode is disposed so as to traverse the pixel; and said common electrode commonly uses a part of said common electrode wire.

35. The liquid crystal display device as claimed in claim 33,

- 20       wherein a plurality of said common electrodes and said pixel electrodes are arranged in the pixel.

36. The liquid crystal display device as claimed in claim 34,

- wherein said common electrode is formed in a grid shape so as to surround a pixel; said pixel electrode is disposed so as to traverse the pixel; and said common electrode commonly uses a part  
25       of said common electrode wire.

37. The liquid crystal display device as claimed in claim 34,

- wherein a plurality of said common electrodes and said pixel

38. The liquid crystal display device as claimed in claim 35,  
wherein said common electrode is formed in a grid shape so as  
to surround a pixel; said pixel electrode is disposed so as to  
traverse the pixel; and said common electrode commonly uses a part  
of said common electrode wire.

39. The liquid crystal display device as claimed in claim 35,  
wherein a plurality of said common electrodes and said pixel  
electrodes are arranged in the pixel.